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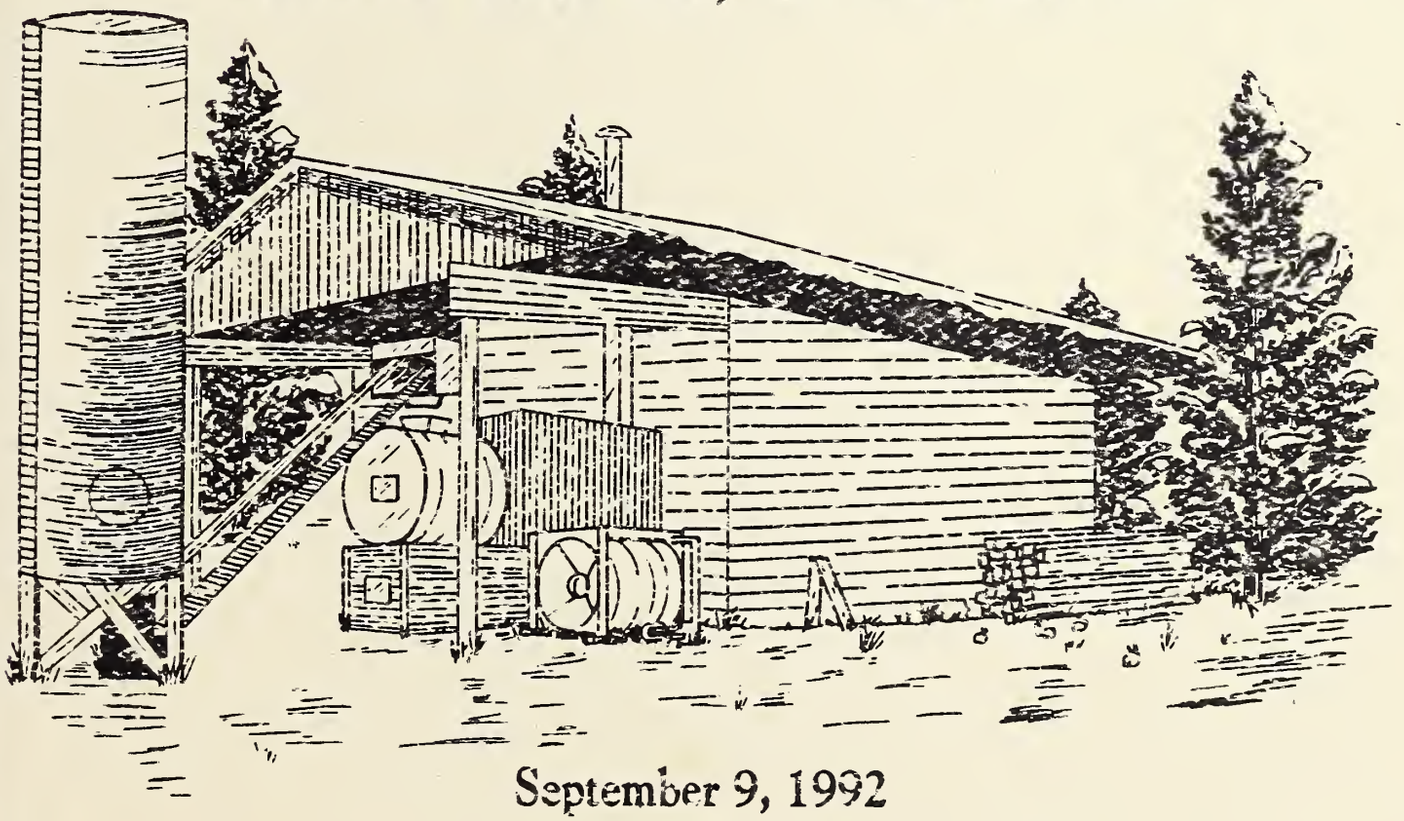

September 9, 1992

Prepared for

Howard E. Haines, Bioenergy Engineering Specialist
Montana Department of Natural Resources and Conservation, Energy Division

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MILL RESIDUE AVAILABILITY IN MONTANA, 1990-2000

Prepared by

Charles E. Keegan III
and
Daniel P. Wichman
Bureau of Business and Economic Research
University of Montana
Missoula, Montana 59812
(406) 243-5113

Prepared for

Howard E. Haines, Bioenergy Engineering Specialist
Montana Department of Natural Resources and Conservation, Energy Division
P.O. Box 202301
1520 East Sixth Avenue
Helena, Montana 59620-2301
(406) 444-6697

September 9, 1992

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Project Scope: The results of this project identify, by county or reporting district, the following: (a) the gross mill residue available, (b) the expected consumption, (c) the mill residue used, and (d) the amount of unused residues. The contractor will report actual amounts for each year from 1986 through 1990, and project the annual amounts of residues for the time period of 1991 through 2000.

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Mill Residue Availability in Montana, 1990-2000
Executive Summary

"Mill residue" is a general term used to describe the portion of timber processed by a milling facility that does not become part of the final product.

In 1990, Montana's forest products industry generated about 2,411 thousand bone dry tons (MBDT) or 192,908 thousand cubic feet (MCF) of mill residue. About 99 percent—2,380 MBDT (190,356 MCF)—was produced by sawmills and plywood plants. The remaining one percent—32 MBDT (2,552 MCF)—was produced by manufacturers of log homes, utility poles, posts and small poles, and cedar products. Ninety-six percent—2,280 MBDT (182,404 MCF)—of sawmill and plywood plant residue was used in 1990. Virtually all coarse residue, planer shavings, and sander dust produced in 1990 was committed to use. Estimated volume of unused sawdust and bark from sawmills and plywood plants in 1990 was 135 MBDT (10,812 MCF). Secondary wood products manufacturers generated an additional 5-10 MBDT (400-800 MCF) of wood residue in 1990.

This study by the University of Montana Bureau of Business and Economic Research (BBER), indicates that the anticipated decrease in available mill residue supply within the state did occur and is projected to worsen (see tables 1a & 1b). Despite the decreasing residue supply, however, facilities that rely on residues for fuel and fiber should be able to operate at current levels by first supplementing the supply from mill residues from outside the state, and then by substituting other mill residues such as bark for sawdust for fuel.

BBER also updated the sawmill and plywood residue factors in Table 2 to reflect current practice in Montana. These factors can be used to estimate gross residue generated at a specific plant.

Table 1a.
Summary of Montana Mill Residues
Actual Amounts in 1990
in Thousands of Oven Dry Tons per Year

Source and Type	Generated	Demand	Unused	Needed to Meet Demand
Sawmills and Plywood Plants				
Coarse	1,144	1,144	0	0
Sawdust	400	350	50	0
Sander Dust	18	18	0	0
Planer Shavings	329	365	0	36
Bark	489	404	85	0
Total, Sawmills and Plywood Plants	2,380	2,281	135	36
Other Products	32	—	—	

Table 1b.
Summary of Montana Mill Residues
Projected Annual Amount, 10-Year Average, 1991 to 2000
in Thousands of Oven Dry Tons per Year

Source and Type	Generated	Demand	Unused	Needed to Meet Demand
Sawmills and Plywood Plants				
Coarse	897	897	0	0
Sawdust	322	350	0	28
Sander Dust	13	13	0	0
Planer Shavings	263	365	0	102
Bark	384	344	40	0
Total, Sawmills and Plywood Plants	1,879	1,969	40	130
Other Products	24		—	—

Table of Contents

Project Scope ii

Executive Summary iii

Introduction 1

Estimating the Supply of Mill Residue 1

Residue Requirements in Montana 4

Residue Production 4

Consumption Versus Supply 4

Secondary Wood Products Industry 8

Implications and Outlook 8

Bibliography 13

Appendix A 15

Appendix B 17

Appendix C 19

Introduction

"Mill residue" is a general term used to describe the portion of timber processed by a milling facility that does not become part of the final product. All timber processing facilities in Montana generate mill residue. Typically, 40 to 60 percent of the wood fiber processed by Montana's forest products industry ends up as mill residue (Keegan et al. 1990). The term "residue" often implies waste, but this is misleading because most of Montana's mill residue is used in some fashion. Mill residue is the major source of wood fiber for the pulp and paper, particleboard, and medium density fiberboard industries in Montana and other states in the inland Northwest. It also is an important source of energy used to dry wood products, provide heat, generate electricity, and is feedstock for producing pelletized fuel. Other uses include animal bedding, garden mulch, and fuel for wood burning stoves in homes., garden mulch, and fuel for wood burning stoves in homes.

In the past, Montana's forest products industry produced more residue than it consumed. In the late 1980s, record lumber and plywood production created large residue excesses which received increased attention as a possible raw material supply for industrial expansion. The feasibility of such expansion depends on a steady supply of available mill residue.

This paper contains estimates of mill residue production and consumption in Montana for calendar year 1990. Residue estimates are presented for geographic areas of the state. The boundaries of these areas are consistent with the lumber reporting areas published in the Western Wood Products Association's *Statistical Yearbook of the Western Lumber Industry*. Figure 1 illustrates these reporting areas. Average annual mill residue availability for 1991-2000 was estimated on the basis of "most likely" timber harvest levels. These levels were determined through a timber supply study performed by a multi-agency study team at the request of the Montana Society of American Foresters.

Estimating the Supply of Mill Residue

The University of Montana Bureau of Business and Economic Research (BBER) uses the Forest Industries Data Collection System (FIDACS) to obtain mill level information on the primary forest products industry in Montana and adjacent states. The FIDACS census—last conducted for Montana in 1988—allows BBER to estimate how much mill residue is generated per unit volume of product manufactured or per unit of timber processed.

For sawmills and plywood plants, which generate over 98 percent of Montana's residue, BBER used its "Mill Residue Assessment and Simulation System" to estimate residue for 1990 (see appendix B). This project uses the simulation system to provide residue estimates with the updated residue volume factors from the 1988 FIDACS. Lumber production figures were obtained from the Western Wood Products Association's *Statistical Yearbook of the Western Lumber Industry, 1990*. Plywood production figures were obtained from American Plywood Association, 1991.

Residue production estimates for other producers are from the 1988 FIDACS, the most recent year for which production or timber use figures are available.

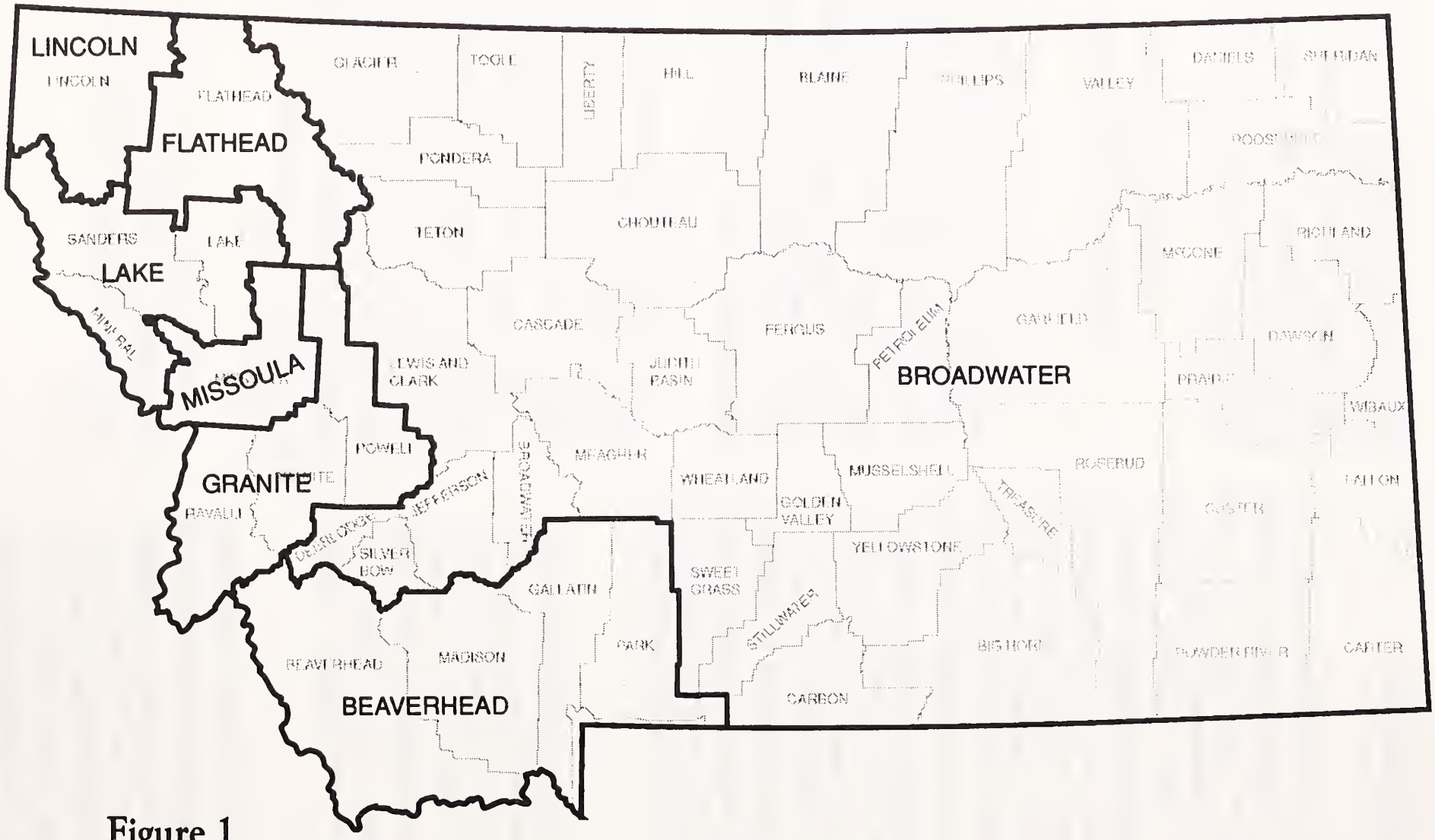

Figure 1
Residue Reporting Regions

Sawmills and Plywood Plants: Residue from sawmills and plywood plants is the major focus of this paper. In the past, these facilities have produced over 98 percent of the residue generated by Montana's forest products industry.

Several types of mill residue are produced by sawmills and plywood plants:

- Coarse or chippable residue consisting of slabs, edging, and trim from lumber manufacturing, log ends from sawmills and plywood plants, pieces of veneer unsuitable for plywood manufacture, and peeler cores from plywood plants;
- Fine residue consisting of planer shavings and sawdust from sawmills and sander dust from plywood plants; and,
- Bark from sawmills and plywood plants.

On average, sawmills in Montana generate 1.40 bone dry tons (112 cubic feet) of residue per thousand board feet of lumber produced (table 2)[1]. Plywood plants generate .48 bone dry tons (38 cubic feet) of residue per one thousand square feet of plywood (3/8-inch basis) produced.

Other Timber Processing Facilities: Manufacturers of log homes, utility poles, posts and small poles, and cedar products also generate mill residue. Residue includes log ends, broken or rotten pieces, bark, slabs from sawn house logs, and shavings or peelings from house logs, utility poles, posts, and small poles.

TABLE 2
Sawmill and Plywood Residue Factors

	Sawmills		Plywood Plants	
Type of Residue	Bone Dry Tons/MBF[a]	Cubic Feet/MBF	Bone Dry Tons/MSF[b]	Cubic Feet/MSF
Coarse[c]	0.64	51	0.30	24
Sawdust	0.28	22	—	—
Sander dust	—	—	0.03	2
Planer shavings	0.22	18	—	—
Bark	0.26	21	0.15	12
TOTAL	1.40	112	0.48	38

Sources: Bureau of Business and Economic Research, The University of Montana, 1977, 1981, 1982, 1986, 1989.
[a] Bone dry tons of residue generated per thousand board feet (MBF) of lumber produced.
[b] Bone dry tons of residue generated per thousand square feet (MSF) of 3/8-inch plywood produced.
[c] Material suitable for chipping such as slab, edging, and trimmings.

[1] For Montana and surrounding area, a bone dry ton is equal to 2,000 pounds of wood fiber, oven-dry basis. This analysis assumed 80 cubic feet of wood fiber—solid wood equivalent—per bone dry ton.

Residue Requirements in Montana

Mill residue use by firms in Montana was estimated on the basis of BBER's periodic census of the forest products industry, trade journals and other published sources, and discussions with industry personnel.

The major uses of mill residue in Montana include the following:

1) *The pulp and paper industry*. This sector uses coarse residue and some sawdust for raw material to manufacture paper. Fine residue and bark also are used as fuel.

2) *Reconstituted board plants*. The particleboard plant and medium density fiberboard plant use planer shavings and sawdust as raw material. Fine residues and bark also are used as fuel.

3) *Sawmills and plywood plants*. These facilities use a portion of the fine residue and bark they generate as fuel to dry lumber and veneer, generate heat, or both.

4) *Energy facilities*. These facilities use primarily bark and fine residue as fuel to produce process heat or generate electricity.

5) *Reconstituted fuel pellet facilities*. These facilities use fine residue to produce wood fuel pellets.

6) *Other users*. Other uses of mill residue in Montana include decorative bark, garden mulch and compost, animal bedding, and firewood.

Residue Production

Given the 1990 production (1,459 million board feet of lumber and 711 million square feet of plywood), Montana sawmills and plywood plants generated about 2,380 MBDT (190,356 MCF) of residue (tables 3 and 4). An additional 32 MBDT (2,552 MCF) of residue, was generated by log home, utility pole, post and small pole, and cedar products facilities, for a total of 2,411 MBDT (192,908 MCF). Production for various regions is shown in tables 3 and 4.

Consumption Versus Supply

All of the residue produced by plywood plants and about 95 percent of the residue produced by Montana's sawmills was used in 1990. Virtually all coarse residue was used. Coarse residue use exceeded 95 percent of total supply and any prospective new users would have to compete directly with existing pulp and paper mills for this component of mill residue (Keegan et al. 1990).

In 1990, an estimated 99 MBDT (7,952 MCF) of fine residue and bark from sawmills was not used (tables 5 and 6). Unused sawdust amounted to 50 MBDT (4,000 MCF). The volume of unused bark was 85 MBDT (6,812 MCF). For 1990, the simulation program showed that Montana facilities used more planer shavings than were produced in the state. This deficit was alleviated by supplementing supplies with shavings from other states and alternative wood fiber sources . Major facilities depending on residue continued to operate at normal levels.

BBER's analysis indicated that Flathead County had the highest volume of unused residue (see tables 3, 4, 5 and 6 for details). However, substantial volumes of unused residue also were present in western and southwestern Montana.

Table 3

Mill Residue Generated by Montana Facilities, 1990

Thousand Bone Dry Tons

Sawmill, Plywood, and Other Product Residues by Reporting Region

	Coarse	Sawdust	Sander Dust	Planer Shavings	Bark	Other[2] Product Residue	Total
Beaverhead Area[1]	92.5	40.0	0	32.5	37.5	4.5	207.0
Broadwater Area	56.3	23.8	0	20.0	22.5	4.9	127.4
Flathead County	208.8	90.0	[a]	73.8	86.3	6.2	464.9
Granite Area	128.8	55.0	0	45.0	52.5	8.1	289.4
Lake Area	153.8	66.3	0	55.0	63.8	5.1	343.9
Lincoln County	203.8	87.5	[a]	72.5	83.8	0.9	448.3
Missoula County	86.3	37.5	[a]	30.0	36.3	2.2	192.1
Statewide Sawmill Residue	930.0	400.0	[a]	328.8	382.5	—	2,041.3
Statewide Plywood Residue[a]	213.8	0	18.2	0	106.3	—	338.3
Total Sawmill and Plywood	1,143.8	400.0	18.2	328.8	488.8	—	2,379.6
Other Producers	—	—	—	—	—	31.9	31.9
TOTAL	1,143.8	400.0	18.2	328.8	488.8	31.9	2,411.4

Notes: Values may not add to totals due to rounding.

[1] See figure on page 2 for illustration of geographic areas within Montana.

[2] Other products include house logs, utility poles, post and small poles, and cedar products.

[a] Plywood residue is reported on a statewide basis to avoid disclosing plant level information.

Table 4

Mill Residue Generated by Montana Facilities, 1990

Thousand Cubic Feet

Sawmill, Plywood, and Other Product Residues by Reporting Region

	Coarse	Sawdust	Sander Dust	Planer Shavings	Bark	Other[2] Product Residue	Total
Beaverhead Area[1]	7,400	3,200	0	2,600	3,000	360	16,560
Broadwater Area	4,500	1,900	0	1,600	1,800	392	10,192
Flathead County	16,700	7,200	[a]	5,900	6,900	496	37,196
Granite Area	10,300	4,400	0	3,600	4,200	648	23,148
Lake Area	12,300	5,300	0	4,400	5,100	408	27,508
Lincoln County	16,300	7,000	[a]	5,800	6,700	72	35,872
Missoula County	6,900	3,000	[a]	2,400	2,900	176	15,376
Statewide Sawmill Residue	74,400	32,000	[a]	26,300	30,600	—	163,300
Statewide Plywood Residue[a]	17,100	0	1,456	0	8,500	—	27,056
Total Sawmill and Plywood Residues	91,500	32,000	1,456	26,300	39,100	—	190,356
Other Producers	—	—	—	—	—	2,552	2,552
TOTAL	91,500	32,000	1,456	26,300	39,100	2,552	192,908

Notes: Values may not add to totals due to rounding or truncating.

[1] See figure on page 2 for illustration of geographic areas within Montana.

[2] Other products include house logs, utility poles, post and small poles, and cedar products.

[a] Plywood residue is reported on a statewide basis to avoid disclosing plant level information.

Table 5
Unused Residue from Sawmills and Plywood Plants
Montana, 1990
Thousand Bone Dry Tons

	Sawdust	Shavings	Bark	Total
Beaverhead Area[1]	31.3	0.0	2.5	33.8
Broadwater Area	23.8	- 9.8	8.8	22.8
Flathead County	0.0	0.0	33.9	33.9
Granite Area	0.0	- 3.0	0.0	- 3.0
Lake Area	0.0	- 1.2	0.0	- 1.2
Lincoln County	- 2.0	- 21.8	24.5	0.7
Missoula County	- 3.0	0.0	15.5	12.5
Total	**50.1**	**- 35.8**	**85.2**	**99.5**

Notes: Negative numbers indicate that residue needs would be met from sources outside of the area or county (including from out-of-state) or from stockpiles of materials within the area or county.
[1] See figure on page 2 for illustration of geographic areas in Montana.
Values may not add to totals due to rounding.

Table 6
Unused Residue from Sawmills and Plywood Plants
Montana, 1990
Thousand Cubic Feet

	Sawdust	Shavings	Bark	Total
Beaverhead Area[1]	2,500	0	200	2,700
Broadwater Area	1,900	- 780	704	1,824
Flathead County	0	0	2,712	2,712
Granite Area	0	- 240	0	- 240
Lake Area	0	- 96	0	- 96
Lincoln County	- 160	- 1,744	1,960	56
Missoula County	- 240	0	1,236	996
Total	**4,000**	**- 2,860**	**6,812**	**7,952**

Notes: Negative numbers indicate that residue needs would be met from sources outside of the area or county (including from out-of-state) or from stockpiles of materials within the area or county.
[1]See figure on page 2 for illustration of geographic areas in Montana.
Values may not add to totals due to rounding.

Secondary Wood Products Industry

Montana's secondary wood products industry uses wood products such as lumber to make other products such as cabinets, furniture, wood carvings, picture frames, joists and trusses. These manufacturers generate various types of mill residue including sawdust, planer shavings, sander dust, and trim pieces. BBER surveyed the larger secondary manufacturers in the state to determine their production and consumption of wood residue.

This survey revealed that Montana's secondary wood products industry produces 5-10 MBDT (400-800 MCF) of sawdust, planer shavings, sander dust, and trim ends annually. Most of the residue is currently disposed of at private landfills. However, new environmental regulation enforced by the Department of Health and Environmental Sciences will add additional per ton fee for disposal of wood waste at these landfills causing some manufacturers to investigate new markets for their wood fiber.

Implications and Outlook

The 1990 level of lumber and plywood production indicates enough mill residue is available in some areas of the state to support a modest expansion of facilities that make use of residue. The most likely use of the material would be for energy in the form of heat and electric generation or the production of pelletized fuel. The amount of unused residue probably is not enough to justify the development of a new manufacturing facility such as a medium density fiberboard plant.

Mill residue supplies can fluctuate sharply, primarily as lumber and plywood production fluctuates. The 1990 production of lumber and plywood was down slightly from the record levels seen in the late 1980s. Given the recent trends in available timber supply, mill residue supply probably will be lower in the future. At least one new wood fuel pellet facility is now being developed to use some of the excess residue.

A study of the timber supply situation in Montana was performed by a multi-agency study team at the request of the Montana Society of American Foresters. The study indicates that future annual timber harvest for all land ownerships in Montana will be 25 percent below the average annual harvest level of 1986-1990 (Flowers, 1992). This would mean a reduction to about 890 million board feet (MMBF), (Scribner) of timber processed annually by the lumber and plywood industries. A commensurate decline in processing levels at other facilities—log home, utility pole, post and small pole, and cedar products—would mean another 20 MMBF of timber processed annually in addition to the 890 MMBF processed by sawmills and plywood plants.

Using these timber harvest estimates for purposes of this analysis, the mill residue supply was estimated with the assumption that 1,168 million board feet of lumber and 507 million square feet (3/8-inch basis) of plywood would be produced annually by Montana's mills.

Tables 7 and 8 show the 10-year annual average of residues generated. Tables 9 and 10 show the amount of residue available for each region in the state. Tables 9 and 10 refer only to sawmills and plywood plants that have been suppliers of residue in the past. These tables indicate shortages of

sawdust, planer shavings and bark in some regions of the state if residues are consumed at the rate they have been in the past. The estimated deficit of planer shavings will be about 102 MBDT (8,160 MCF). The estimated sawdust deficit will be 28 MBDT (2,200 MCF). Bark will be in short supply in some regions, but the state will have an estimated average annual surplus of 40 MBDT (3,198 MCF).

The residue generated by this level of production would leave virtually no excess for additional users. The decline of available mill residue below the 1990 level does not necessarily mean cutbacks will occur at facilities dependent on residues. Other sources of mill residue are available, including out of state residues, stockpiles, and residues from secondary manufacturers. It might be possible to use alternative sources of raw materials such as recycled paper and residues from precommercial timber thinning. Facilities in need of residue can and have drawn on resources from outside the state, primarily northern Idaho, South Dakota and Wyoming which had some unused planer shavings, sawdust, chips, and bark.

As indicated on page 8, secondary wood products manufacturers produce 5-10 thousand tons (400-800 MCF) of residue annually, including sawdust, planer shavings, sander dust, and trim ends from lumber. Although large concentrations of these materials typically do not occur at any one site, they might be used to fill residue needs of smaller facilities, in particular the wood pellet mills.

Given the findings of the timber supply study—a conservative prediction of 25 percent decline in Montana's timber harvest—it appears that future residue generated in the state along with supplemental supplies from other states will provide enough residue to keep Montana's residue-using facilities operating at current levels. There would be little potential for expansion.

Table 7

Expected Average Annual Mill Residue Available
Montana Facilities, 1991-2000
Thousand Bone Dry Tons

Sawmill, Plywood, and Other Product Residues by Reporting Region

	Coarse	Sawdust	Sander Dust	Planer Shavings	Bark	Other[2] Product Residue	Total
Beaverhead Area[1]	73.8	31.3	0	26.3	30.0	3.4	164.6
Broadwater Area	36.3	16.3	0	12.5	15.0	3.7	83.7
Flathead County	170.0	73.8	[a]	60.0	70.0	4.7	378.4
Granite Area	96.3	41.3	0	33.8	40.0	6.1	217.3
Lake Area	120.0	52.5	0	42.5	50.0	3.8	268.8
Lincoln County	173.8	75.0	[a]	61.3	71.3	0.7	381.9
Missoula County	75.0	32.5	[a]	26.3	31.3	1.7	166.6
Statewide Sawmill Residue	745.0	322.5	[a]	262.5	307.5	—	1,637.5
Statewide Plywood Residue[a]	152.1	0	12.7	0	76.1	—	240.8
Other Producers	—	—	—	—	—	23.9	23.9
TOTAL	**897.1**	**322.5**	**12.7**	**262.5**	**383.6**	**23.9**	**1,902.3**

Notes: Values may not add to totals due to rounding.
[1] See figure on page 2 for illustration of geographic areas within Montana.
[2] Other products include house logs, utility poles, post and small poles, and cedar products.

[a] Plywood residue is reported on a statewide basis to avoid disclosing plant level information.

Table 8

Expected Average Annual Mill Residue Available
Montana Facilities, 1991-2000
Thousand Cubic Feet

——— Sawmill, Plywood, and Other Product Residues by Reporting Region ———

	Coarse	Sawdust	Sander Dust	Planer Shavings	Bark	Other[2] Product Residue	Total
Beaverhead Area[1]	5,900	2,500	0	2,100	2,400	270	13,170
Broadwater Area	2,900	1,300	0	1,000	1,200	294	6,694
Flathead County	13,600	5,900	[a]	4,800	5,600	372	30,272
Granite Area	7,700	3,300	0	2,700	3,200	486	17,386
Lake Area	9,600	4,200	0	3,400	4,000	306	21,506
Lincoln County	13,900	6,000	[a]	4,900	5,700	54	30,554
Missoula County	6,000	2,600	[a]	2,100	2,500	132	13,332
Statewide Sawmill Residue	59,600	25,800	[a]	21,000	24,600	—	131,000
Statewide Plywood Residue[a]	12,168	0	1,014	0	6,084	—	19,266
Other Producers	—	—	—	—	—	1,914	23.9
TOTAL	71,768	25,800	1,014	21,000	30,684	1,914	152,180

Notes: Values may not add to totals due to rounding.

[1] See figure on page 2 for illustration of geographic areas within Montana.

[2] Other products include house logs, utility poles, post and small poles, and cedar products.

[a] Plywood residue is reported on a statewide basis to avoid disclosing plant level information.

Table 9
Expected Average Annual Unutilized Residue from Sawmills and Plywood Plants Montana, 1991-2000
Thousand Bone Dry Tons

	Sawdust	Shavings	Bark	Total
Beaverhead Area[1]	22.5	- 6.3	- 1.3	15.0
Broadwater Area	16.3	- 17.3	6.3	5.3
Flathead County	- 16.3	- 13.8	22.2	- 7.8
Granite Area	- 13.8	- 14.3	- 5.0	- 33.0
Lake Area	- 13.8	- 13.7	- 6.3	- 33.7
Lincoln County	- 14.5	- 33.1	16.5	- 31.0
Missoula County	- 8.0	- 3.8	7.5	- 4.2
Total	**- 27.5**	**- 102.0**	**40.0**	**- 89.5**

Notes: Negative numbers indicate that consumption of residue is produced to meet the demand in an area. The shortages are an average for the 10-year period, so some areas may not experience a shortage in the early part of the decade, but a shortage will occur later. It is expected that the residue needs would be met from sources outside of the area or county (including from out-of-state) or from stockpiles of materials within the area or county.

[1] See figure on page 2 for illustration of geographic areas in Montana. Values may not add to totals due to rounding.

Table 10
Expected Average Annual Unutilized Residue from Sawmills and Plywood Plants Montana, 1991-2000
Thousand Cubic Feet

	Sawdust	Shavings	Bark	Total
Beaverhead Area[1]	1,800	- 500	- 100	1,200
Broadwater Area	1,300	- 1,380	500	420
Flathead County	- 1,300	- 1,100	1,774	- 626
Granite Area	- 1,100	- 1,140	- 400	- 2,640
Lake Area	- 1,100	- 1,096	- 500	- 2,696
Lincoln County	- 1,160	- 2,644	1,320	- 2,484
Missoula County	- 640	- 300	603	- 337
Total	**- 2,200**	**- 8,160**	**3,198**	**- 7,162**

Notes: Negative numbers indicate that consumption of residue is produced to meet the demand in an area. The shortages are an average for the 10-year period, so some areas may not experience a shortage in the early part of the decade, but a shortage will occur later. It is expected that the residue needs would be met from sources outside of the area or county (including from out-of-state) or from stockpiles of materials within the area or county.

[1] See figure on page 2 for illustration of geographic areas in Montana. Values may not add to totals due to rounding.

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Appendix A

Estimated Volume of Wood Residue Generated by Primary Wood Products Manufacturing[1] in Montana, 1986, 1987, 1988, 1989, and 1990

——— Volumes in Thousand Cubic Feet ———

Year	Total Residue Generated	Residue Used	Residue Unused
1986	216,650	193,400	23,250
1987	227,750	200,500	27,250
1988	193,850	174,900	18,950
1989	205,650	189,400	16,250
1990	192,908	182,404	10,504

[1] Includes manufacturing at sawmills, plywood plants, utility pole plants, house log plants, cedar products plants, and post and small pole plants.
Source: Bureau of Business and Economic Research, The University of Montana, Missoula, Montana. 1992.

Appendix B

Residue Factor Changes

The University of Montana, Bureau of Business and Economic Research (BBER) developed the "Mill Residue Assessment and Simulation System" in 1987. This computer program is designed to generate a report of residues produced by Montana's sawmills and plywood plants and the unutilized volume of that residue.

The inputs of the program are lumber production for various geographic regions, plywood production for the state, and residue volume factors which specify the volume of residue generated per unit volume of lumber or plywood produced. Lumber production is obtained from the Western Wood Products Association, and plywood production is obtained from the American Plywood Association. Residue factors were developed by the BBER based on mill census information, published sources, and discussion with industry personnel.

The table below lists the original residue volume factors as well as the updated volume factors. Factors for sawmills are in Cunits of residue per thousand board feet of lumber produced. Factors for plywood plants are in Cunits of residue per thousand square feet, 3/8 inch basis of plywood produced.

Cunits/MBF for sawmills and Cunits/MSF for plywood plants.

	Original Factors	Updated Factors
Sawmills		
Coarse[1]	.53	.51
Sawdust	.23	.22
Planer shavings	.21	.18
Bark	.22	.21
Total	**1.19**	**1.12**
Plywood Plants		
Coarse	.28	.24
Sander dust	.02	.02
Bark	.12	.12
Total	**.42**	**.38**

[1] Coarse material consists of slabs, broken pieces, and trim ends from sawmills not sawn into lumber, peeler cores, and unusable pieces of veneer from plywood plants, as well as any other pieces from sawmills and plywood plants which are chipped.

Updated factors have been used by the BBER for calculating residue since 1988.

Note: A Cunit is 100 cubic feet solid wood equivalent or 2,500 lbs. of oven-dry wood.

Appendix C

Grant Administration

This report, *Mill Residue Availability in Montana, 1990-2000*, marks the completion of project. The budget to complete Milestone 1 was $2,981, and the budget to complete Milestone 2 was $1,988. The total budget for the completion of the project was $4,969.

Milestone 1

This milestone estimates the gross mill residue amounts, demand amounts, and used and available residue based on the amount of wood products produced in 1990. These estimates are for the state as a whole and for counties or county groups used as standard reporting entities by the Western Wood Products Association.

Milestone 2

This milestone estimates the gross mill residue amounts, demand amounts, and used and available residue based on the expected average annual amount of wood products produced for the period 1992-2000. These estimates are for the state as a whole and for counties or county groups used as standard reporting entities by the Western Wood Products Association.